In the United State Patent and Trademark Office

Appn. Number:	US 10/599,868 national phase
International Appn Nr. :	WO 2005/112041 / PCT/EP2005/051405
Applicants:	Robert Desbrandes, Daniel L. Van Gent
Tittle :	REMOTE COMMUNICATION METHOD AND DEVICE USING NUCLEAR ISOMERS

Examiner: Johannes MONDT

Our Ref. EQ/2011/04/12/US02/a

Givarlais, France, 2011 April 16th

Amendment in response to the action dated January 20th, 2011

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir,

We would like to thank you for the examination of our application, and of the IDS, which were submitted on September 25th, 2010.

We are certainly disappointed by the current detailed action at point 4 and 5.

Point 4 mention that our work is not presented academically : Professor Van Gent, and I, have written an article in arXiv on 24 Nov 2004:

- arXiv:nucl-ex/0411050v1

The article described our measurements, and can certainly supplement our specification as it was available in the 12 months prior to the international application. I am providing the article in appendix B as a declaration.

We carried out these extraordinary researches many years ago not within the context of a well financed academic program, but while cLINAC equipment, and other lab

equipment from LSU, were available for maintenance and testing during many week ends between their regular operations. Unfortunately, neither the academic community, nor Louisiana State University had interest pursuing the undertaken work, or replicating the measurements, and Professor Van Gent had to move to other assignments. Hence, we were not able to pursue these developments, which are the early steps of new paradigms in physics. It is very sad that Professor Van Gent is now no longer involved in research while having been **the first US citizen to master quantum transmission using isomer nuclides**. A final statement by the Office that such work lacks "utility" could only be remembered negatively in the future when these technologies will be rediscovered against the currently widely established prejudices. It would also be an injustice that a US citizen be denied its right to article I – section 8 of the constitution of the United States of America, which mandates the Office "*To promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries*".

We believe that special guidance should apply for princeps inventions particularly when they have gone unnoticed from the academic community for 8 years because the overall benefit to Society relies lastly on the goodwill of the Office, and on the inventors willingness to provide for the issuing fee which support the patent system.

Concerning point 2 :

I have removed the added references to the "Table of Isotopes" from Mr. Firestone, and to the articles from Mr. Pontecorvo, Mrs Cauchois and Mr. Veres. It is clear that these documents were general knowledge of the persons skilled in the art at the time of the invention. I would appreciate if the Office could cite these references appropriately in order for the general public to benefit from this basic knowledge in photoactivation.

Concerning the transfer of the original claims to the description:

It is believed that the transferred original claims do not introduce new matter in the application considering MPEP paragraph 2163.06 "Relationship of Written Description Requirement to New Matter" which states that:

"Lack of written description is an issue that generally arises with respect to the subject matter of a claim. If an applicant amends or attempts to amend the abstract, specification or drawings of an application, an issue of new matter will arise if the content of the amendment is not described in the application as filed. Stated another way, information contained in any one of the specification, claims or drawings of the application as filed ***may be added to any other part of the application without introducing new matter****."*

Numbering of the methods, devices and uses: in order avoid any risk of misinterpretation of the numbering, I have referred each method, device and use by a number written in letter so that the one skilled in the art could not interpret such a number as a reference to the figures.

I propose to submit an amended specification taking into account the above mentioned corrections and amendments:

- Description file in revision mode: US02-Desc-B-v1-revision.pdf
  - Reference in the header is E-QUANTIC / US02-C-Revision;
- Clean text for the amended specification: US02-Desc-C-v1.pdf
  - Reference in the header: E-QUANTIC/US02-C.

Concerning points 3 -

We are grateful to the examiner for its consideration of the documents submitted in the IDS. Documents submitted 2010-09-25 are discussed below, because the descriptions of the early discoveries in photoactivation encompass the reasons why the entanglement of gamma rays from the Bremsstrahlung of accelerated electrons could not be transferred significantly to photoactivated isomer nuclides at that time.

Concerning points 4 and 5 -

Concerning the review by Genovese on the state of the art on the hidden variable theories, we can quote the author's abstract "*Nevertheless, at one century since its development, various aspects concerning its very foundations still remain to be clarified. Among them, the transition from a microscopic probabilistic world into a macroscopic deterministic one and quantum non-locality.*"

The present invention is based upon experiments using photoactivated isomer nuclides, and the theoretical models described in Genovese are not related directly to our work. The fact that the theoretical models lead to associated experiments, which are designed to validate, or invalidate some of the assumptions remains very academic. The conclusion of Genevese are very ambivalent: "*However, we have to acknowledge that this personal opinion is not generally shared: on one side some authors deem that the large amount of experimental data disfavouring local hidden variable theories is already largely sufficient for excluding them, on the other side other authors (see for example [504]) claim that the lack of a conclusive experiment after 40 years and in particular the "resistance" of detection loophole to be eliminated could point out a practical impossibility of falsifying local realism. These discussion largely involve methodological questions [474–477] which are amply beyond the purposes of this paper.*"

The present invention is not based upon theories, or mathematical models: it makes use of entangled metastable isomer nucleus. Metastability is usually not considered in the above theoretical models.

The present invention is an application of the discovery of an extraordinary law of nature which has been unnoticed due to the high cost of the equipments required, the dangers of the involved radiations, and the disinterest of those involved in the operation of such equipment for use out of their respective fields of work (medical irradiation, industrial irradiation, etc). Contrary to point 5, the fact that no one skill in the art has thus far succeeded in carrying out the experimental work needed to use the invention is neither significant of an impossibility to replicate such experimental work, nor a sign that such an experimental work is not fully described by the specification: it is only the evidence that no one has undertaken the replication of the invention yet, for the above mentioned reasons. Such disinterest has not always been the case as can be seen from the history of photoactivation:

Referring to the following documents provided in our IDS dated September 25th, 2010, and to the Table of Isotopes in use with the persons skilled in the art:

[8] Firestone R. et al., "Table of Isotopes", Eighth Edition, 1996, Wiley Interscience.

[9] Pontecorvo B., and Lazard A., "Nuclear Isomerism produced by X-rays of the continuous spectrum", Compte Rendus, French Academy of Sciences, 1939, pp. 99-101.

[10] Boivin M., Cauchois Y., and Heno Y., "Nuclear photoactivation of 77Se, 107,109Ar, 111Cd, 115In, and 199Hg", North-Holland Publishing Co., Amsterdam, Nuclear Physics, A137 (1969), pp. 520-530.

[11] Veres A., "Photo-activation if Cadmium-111m and Indium-115m by Cobalt-60 irradiation", International Journal of Applied Radiation and Isotopes, 1963, Volume 14, pp. 123-128, Pergamon Press Ltd.

Mrs Cauchois in [10], studied extensively the photoactivation of a series of metastable nuclides (77Se, 107,109Ar, 111Cd, 115In, and 199Hg) using an accelerator producing accelerated electrons up to 2 MeV (usually referred as KVp). This document illustrates the state of the art in the photoactivation of isomer nuclides.

It is shown that an isomer nuclide can be photoactivated according to a pattern which applies to all isomer nuclides: Figure 1 of [10] shows that an isomer nuclide has a set of **energy gateways** at which gamma rays photoactivate the isomer nuclide. The photoactivated isomer nuclides then **cascade** to the metastable state as can be viewed in the Table of Isotopes [8] for the various isomer nuclides. In fact the energy gateways found in [10] are energy levels now listed in the Table of Isotopes [8] as illustrated for the characteristic lines of energy of Indium 115 (see the diagram below).

Mrs Cauchois in [10] determined the photoactivation gateways, and their respective approximate yields, as shown in Table 4 for Indium 115:

- First identified photoactivation gateway energy is at 600 [+/-10] keV (the leading 0 is a typographical error) with a yield of the order of $2\ 10^{-7}$
- The second identified photoactivation gateway energy is at 830 [+10/-30] keV with a yield of the order of $1.3\ 10^{-7}$
- The third identified photoactivation gateway energy is at 935 [+/-10] keV with a yield of the order of 0.02
- The fourth identified photoactivation gateway energy is at 1070 [+/-10] keV with a yield of the order of 0.3
- The fifth identified photoactivation gateway energy is at 1490 [+10/-20] keV with a yield of the order of 2.

This pattern of the photoactivation gateway energies, and corresponding yields, are very similar for each of the isomer nuclides.

The accelerator used in [10] produces by Bremsstrahlung a spectra of gamma of energies up to 2 MeV. It is known to the one skilled in the art that the sum of the energies of gamma rays produced by the Bremsstrahlung of one accelerated electron is less or equal to the energy of the electron on the target: accordingly it is obvious from our specification that the sum of the energies of entangled gamma rays is less than KVp, which is dependant upon the tuning of the accelerator used.

It shows that while Mrs Cauchois in [10] was able to determine the photoactivation gateway energies and yields, **she was unable to produce significantly the entangled isomer nuclides**, due to the pattern of the yields, and because of the upper KVp of her accelerator:

- While irradiating with a KVp less than 600 keV, there was no photoactivation.
- While irradiating with a KVp from 600 keV to 830 keV, the Bremsstrahlung did not produced groups of two entangled gamma rays with energies higher than the first photoactivation gateway (600 keV), thus producing the regular metastable nuclide with an extremely low yield.
- While irradiating with a KVp from 830 keV to 935 keV, the Bremsstrahlung did not produced groups of two entangled gamma rays with energies higher than the first photoactivation gateway (at 600 keV), thus still producing the regular metastable isomer nuclide with an extremely low yield.

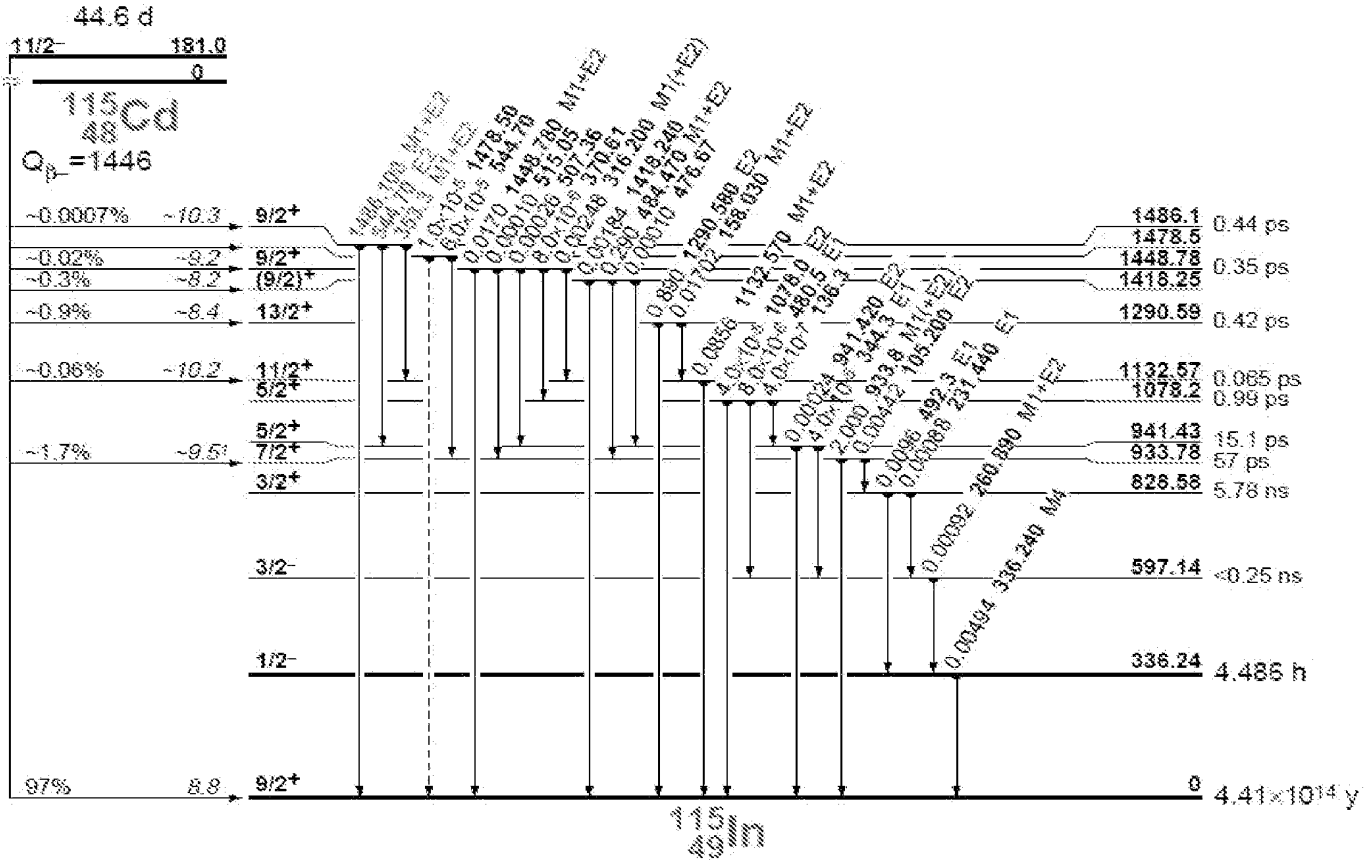

Figure 1. Diagram of the energy levels of Indium 115 (from document [8])

- While irradiating with a KVp from 935 keV to 1070 keV, the Bremsstrahlung did not produced groups of two entangled gamma rays with energies higher than the first photoactivation gateway (at 600 keV), thus still producing the regular metastable isomer nuclide with an extremely low yield of 0.02.
- While irradiating with a KVp from 1070 keV to 1200 keV, the Bremsstrahlung did not produced groups of two entangled gamma rays with energies higher than the first photoactivation gateway (at 600 keV), thus still producing the regular metastable isomer nuclide with a medium yield of 0.3.
- While irradiating with a KVp from 1200 keV to 1490 keV, the Bremsstrahlung did produced some groups of two entangled gamma rays with energies higher than the first photoactivation gateway (at 600 keV). However, because the yield of the first

photoactivation gateway (at 600 keV) is about one millionth of the yield of the fourth photoactivation gateway (at 1078 keV), the percentage of entangled nuclei in the metastable isomer was still insignificant.

- While irradiating with a KVp from 1490 keV to 2000 keV, the Bremsstrahlung did produced some groups of two entangled gamma rays with energies higher than the first, second and third photoactivation gateways. However, because the yield of these photoactivation gateways (at 600, 830 and 935 keV) are less than one hundredth of the yield of the fifth photoactivation gateway (at 1490 keV), the percentage of entangled nuclei in the metastable isomer was still insignificant.
- The same pattern has occurred with the other isomer nuclides. **Hence, Mrs Cauchois in [10] was not able to carry out the first step of our invention**.

Moreover, Mrs Cauchois could only have become aware of the entanglement properties of the photoactivated Indium isomer nuclides if she could have used a KVp of 2150 keV and up, although very feebly until the threshold of 2980 keV (twice the fifth photoactivation gateway energy).

While Mrs Cauchois was not able to detect the effects of the entanglement of gamma produced by the Bremsstrahlung of accelerated electrons due to the limitation of the kVp she used, it appears that the community of researchers missed the possibility of the entanglement of isomer nuclides using photoactivation with higher KVp. One reason may be that other irradiation techniques might have been used to pursue researches in photoactivation of isomer nuclides not using the Bremsstrahlung of accelerated electrons (techniques of cyclotron, or others).

While the pioneer works of Mrs Cauchois and others remain great achievements, it is necessary to take into account the very peculiar reasons of the above academic community failure to fully evaluate the context of our present invention:
we have entangled Indium isomer nuclides samples together using gamma from the Bremsstrahlung of 6 MeV accelerated electrons, AND we have applied this property to communicate remotely using the samples by using Induced Gamma Emission (IGE) on the master sample thus measuring a correlated variation of de-excitation on the slave sample.

Contrary to point 5, the invention, after carefully reading the specification, is not very difficult to carry out by the person skilled in the art, which can be considered a specialist of the photoactivation of isomer nuclides having the capability to setup measurement equipment which are available in the radiation field of work. A cLINAC producing accelerated electrons of 6 MeV allows for the entanglement of Indium samples as taught by the specification. IGE using Fe55 on one sample, the master, allows for the remote control of the de-excitation of the slave sample as described in the specification. Of course, such a person has to overcome his/her own academic prejudices against the feasibility of the invention as is always required with princeps inventions.

Illustration of **direct** Induced Gamma Emission (IGE), i.e. the measurement of deexcitation on a locally stimulated Indium sample:

We have tested IGE using different sources:

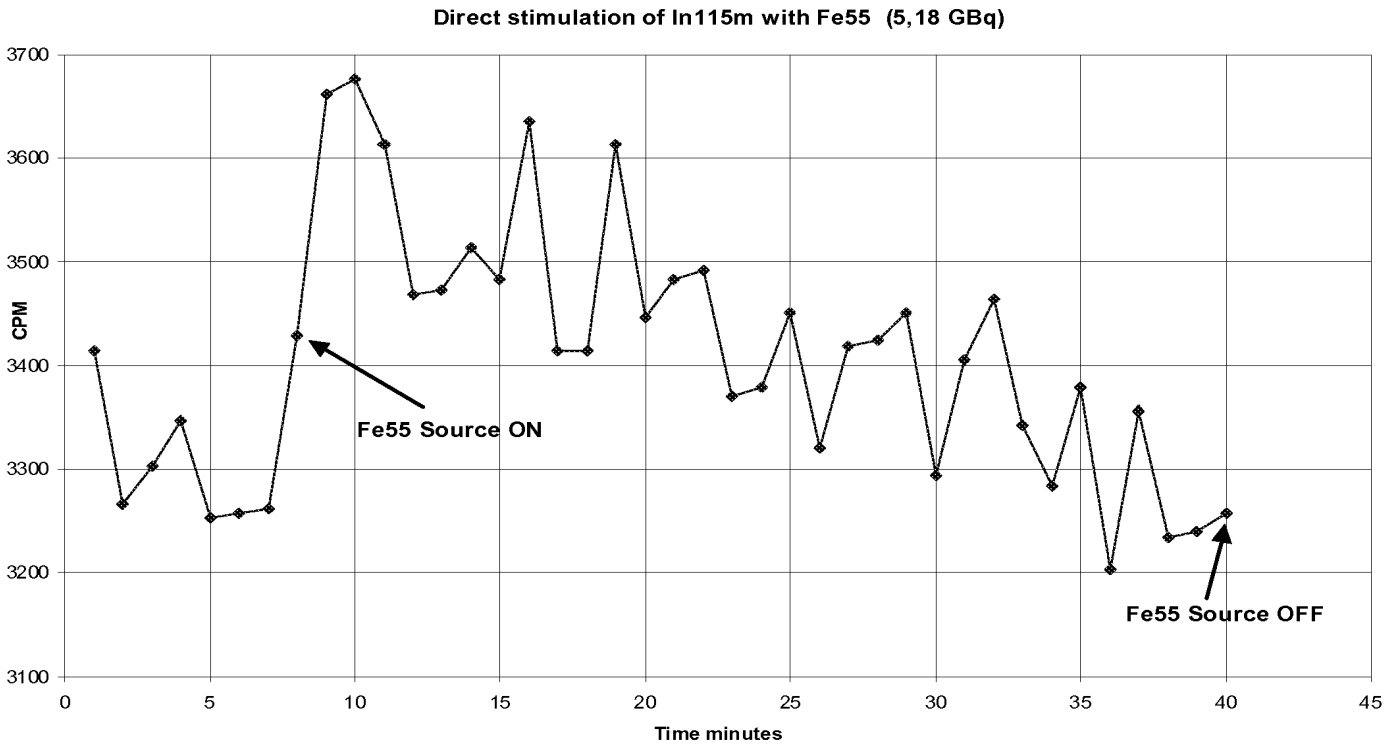

Figure 2. Direct stimulation of Indium 115m with Iron 55.

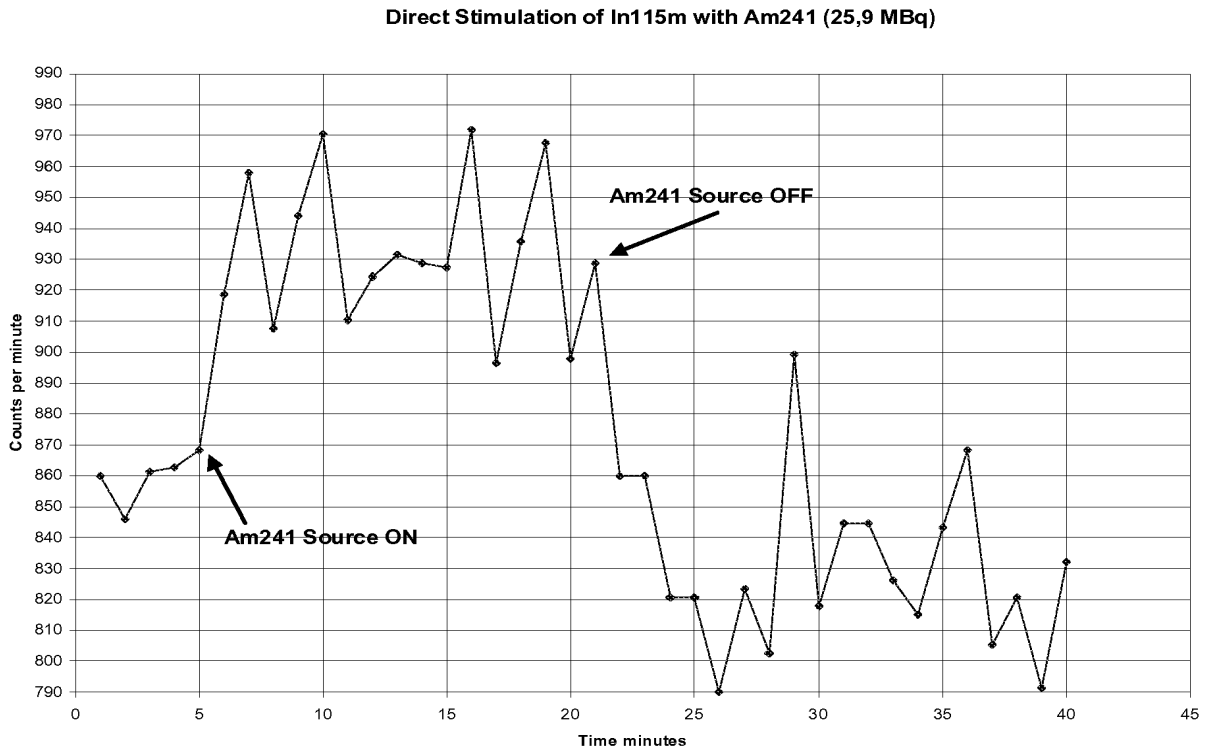

Figure 3. Direct stimulation of Indium 115m with Americium 241.

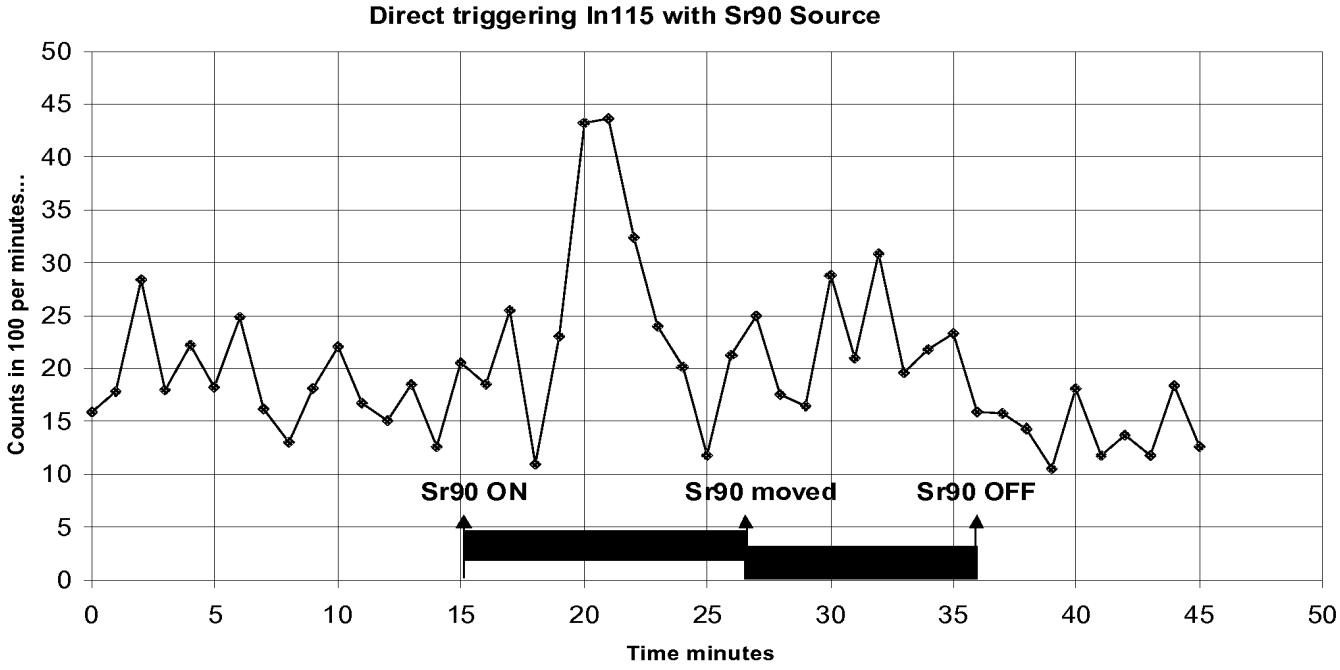

Figure 4. Direct stimulation of Indium 115m with Strontium 90.

Illustration of **remotely** Induced Gamma Emission (IGE), i.e. the measurement of deexcitation on a distant entangled Indium foil ("slave sample") while another entangled Indium foil (the "master" sample) is locally stimulated :

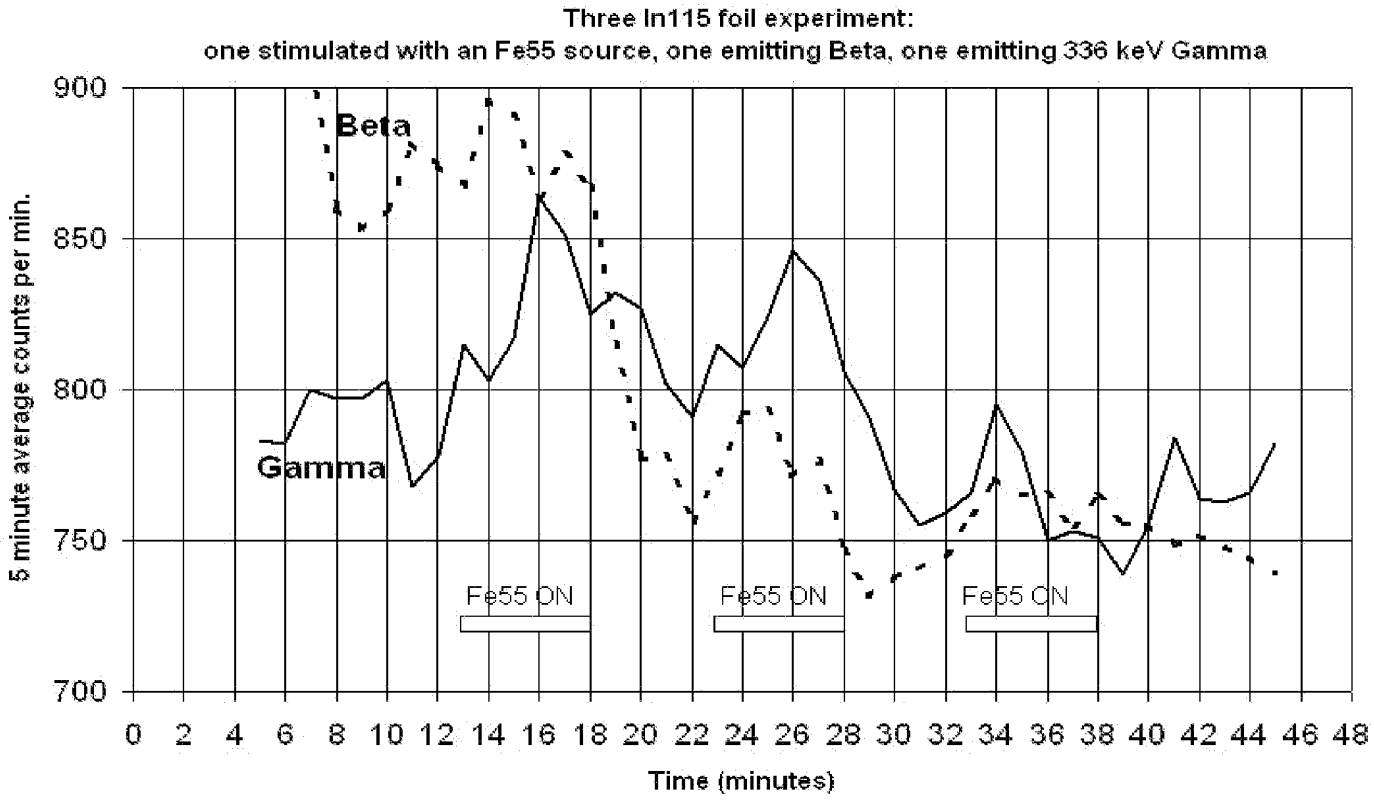

Figure 5. Quantum communication at 12 meters.

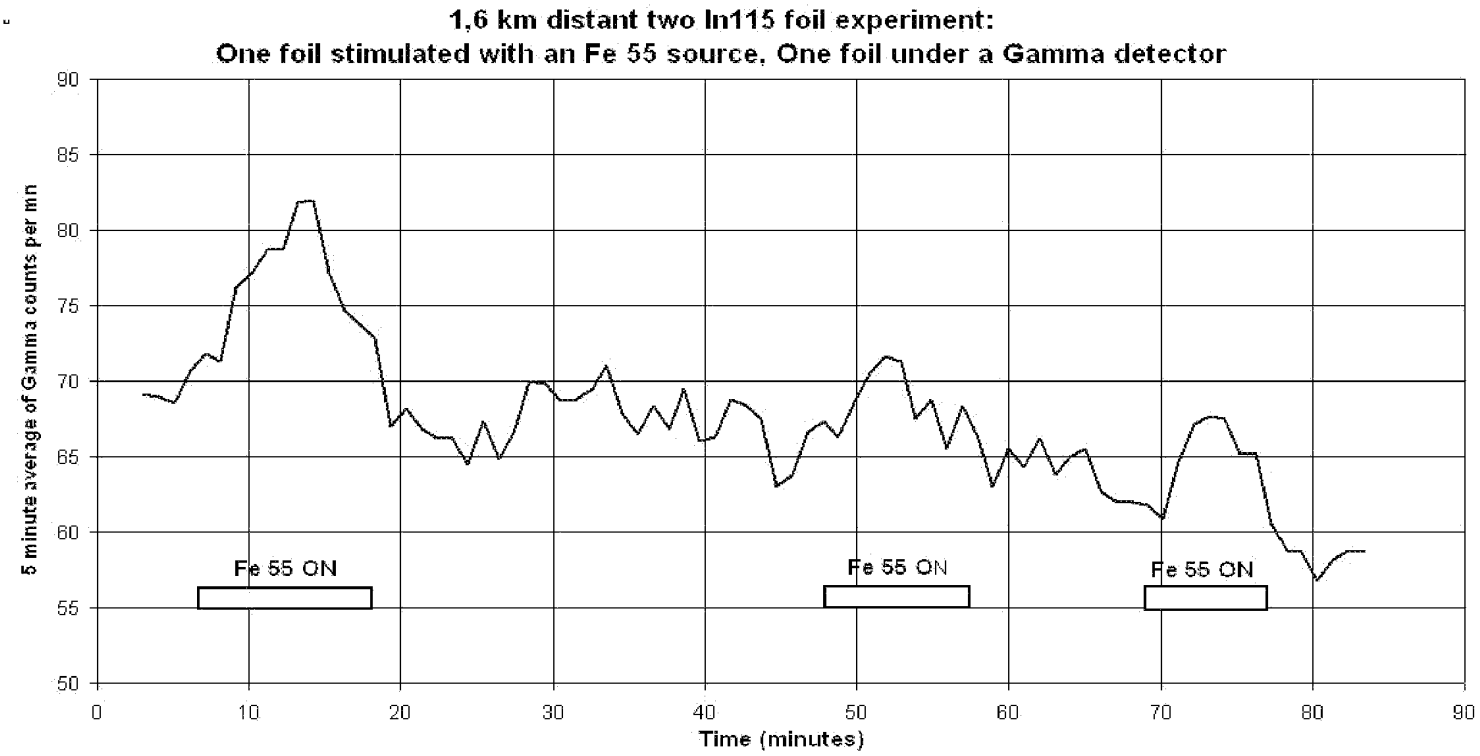

Figure 6. Quantum communication at 1.6 kilometers.

Unfortunately, we could only test the remote IGE using Fe55 for Indium 115m samples located at 12 meters in one set-up (see appendix A) and at 1.6 kilometers in a second set-up (see appendix B). However, the macroscopic effect was very significant : the first quantum transmissions using isomer nuclides was not a Bell inequalities kind of measurements. But one has to concede that the Indium foils were photoactivated to their metastable states until saturation. It means that a large number of the Indium foils nuclei were entangled, allowing for a macroscopic view of the quantum transmission.

Contrary to point 5 assertion, **some physical phenomena present a macroscopic effect of such amplitude that the one skilled in the art does not need the refinements of statistical analysis to assess the utility of their applications**. The present patent specification is such a specific case. The present specification clearly illustrates that a stimulation of Fe55 which produces IGE when applied to the master entangled sample during intervals of a number of minutes, causes the remote deexcitation of the slave Indium sample. This response is measured on a per minutes counts basis. Using an average of the of response to said stimulation intervals allows to

detect those intervals where stimulation occurred. The invention is enabled because the invention does not lay in the optimization of the set up in order to transfer more bit of information. The optimizations and corresponding statistical analysis are within the capacity of the person skilled in the art when it has taken into account all the specification of the present invention.

The one skilled in the art is led to the feasibility of remote communication by using nuclear isomers, when carrying out the experimental setup using Indium samples to transfer a few bit of information over a half life of the isomer nuclide prepared according to the specification. **The law does not request that a utility be high**: it can even be lower than other competing processes. However, such a quantum communication method was at that time the only method having the unique properties of being capable to perform anywhere while being non interceptable. For example, submarines, while in deep dive, can be signaled from earth (or conversely) by using this method. Such quantum communications are of interest, in fact of a "strategic" interest, when considering that resurfacing on a scheduled periodic basis incurs a high risk of being destroyed in certain situations. Evidently other isomer nuclides with longer half lives allow for a "higher" utility for such dedicated communications.

Hence it appears that the specification is in accordance with 35 USC 101 and 35 USC 112 – first paragraph.

Concerning point 6 – This invention is a princeps invention. The reasons for supporting this specific case can be found in those set forth in the reasoning above, and in the appendixes submitted. Claims 69-85 involve a useful method in accordance with 35 U.S.C 101.

Concerning point 7 - This invention is a princeps invention. The reasons for supporting this specific case can be found in those set forth in the reasoning above, and in the appendixes submitted. Claims 69-85 involve a utility in accordance with 35 U.S.C 112, which is supported by the specification and the appendixes submitted.

Concerning point 8 - This invention is a princeps invention. The reasons for supporting this specific case can be found in those set forth in the reasoning above, and in the

appendixes submitted. Claims 69-85 involve a utility in accordance with 35 U.S.C 101, which is supported by the specification and the appendixes submitted. In particular, the method is operative as is declared in the appendixes.

Concerning point 9 – This invention is a princeps invention. The reasons for supporting this specific case can be found in those set forth in the reasoning above, and in the appendixes submitted. Claims 69-85 comply with 35 U.S.C 112, as can be viewed from the careful reading of the specification, and the appendixes submitted.

Concerning point 10 - This invention is a princeps invention. The reasons for supporting this specific case can be found in those set forth in the reasoning above, and in the appendixes submitted. Claims 69-85 comply with 35 U.S.C 112, in particular a carefull analysis of the above Indium decay table from Cd (115, 48) shows that the one skilled in the art considers one metastable state of 4.486 hours half life (refer to the bold line marked ½ -). The one skilled in the art can readily makes the difference between metastable states, and the cascading transient states of various energies, not all being accessible from the ground state In (115, 49). Transient states are very short (less than a picoseconds to nanoseconds). Transient states are well described by [10] and [11]: When the transient state has a gamma emission towards the ground state, as is the case for the 1486 MeV energy, or the 1078 MeV energy, then it is a gateway for photoactivation, which allows for rapid cascading to the one or several metastable states according to the specific isomer nuclide. In the case of Indium a single metastable state. There is absolutely no previously stated fact by us that we may have asserted that Indium would have had more than one metastable state as considered by the one skilled in the art. Hence, the objection of point 10 cannot hold.

The person skilled in the art is perfectly able to differentiate the one or more metastable states from the transient states cascading to the metastable states, or to the ground state. In fact, the diagrams from the table of isotopes, which are available in every radiation laboratory readily allow the person skilled in the art to determine the photoactivation thresholds and the expected yields of the cascades leading to the metastable state. The metastable state is defined with a gamma emission. Hence the person skilled in the art having carried out a quantum transmission according to the specification, knows how it has to operate with other photoactivated isomer nuclides,

provided that the Bremsstrahlung of accelerated electrons of sufficient energy is used to photoactivate such isomer nuclides in accordance with the well known laboratories table of isotopes.

Concerning point 11 - This invention is a princeps invention. The reasons for supporting this specific case can be found in those set forth in the reasoning above, and in the appendixes submitted. Claims 69-85 comply with 35 U.S.C 112, as not being indefinite: The claims particularly point out to the method for remotely communicating using isomer nuclides. The claimed method includes the features required to operate. Because the invention is princeps, there are no reasons by law to restrict such an invention to a very narrow set up. There are no pertinent documents to be opposed, which would require restricting the protection scope. Restricting the protection scope would not give an adequate protection to the inventors as stipulated by the constitution. A careful reading of the claims shows that the protection is already limited to remotely communicating a modulated de-excitation using a system of entangled isomer nuclides. The metes of such a method claim is very reasonable, not trespassing any known uses of isomer nuclides. Due to the high investments required to commercialize this technology, a fair protection is required should the Office expect that such equipment be made available to the public (governments, mine operators, etc) before the end of such a patent in about twelve years.

Concerning point 12 - This invention is a princeps invention. The reasons for supporting this specific case can be found in those set forth in the reasoning above, and in the appendixes submitted. Claims 69-85 comply with 35 U.S.C 112, as not being indefinite: the method is enabled by the specification. Its metes and bounds are in relation to its princeps feature.

I am providing again the declaration with the measurements made with Indium, which I have augmented with the tables of data. These are added for the legacy as I believe that it won't be possible resume the development of commercial prototypes for quantum transmission using isomer nuclides without a US patent granted, because the required investment threshold in these technologies is quite high, and European companies are unlikely to initiate such developments, while launching new startup industries remain to

this day a competitive advantage of the United States. New technologies happen to emerge transiently from time to time, and to resume a few decades later as has been the case with radio in the XIXth century with the invention by Mahlon Loomis (U.S. Patent 129,971 dated July 30th, 1872). However, being late for a major country might not be the same as improvements of these technologies are likely to be initiated next time elsewhere in five, ten or twenty years, for example at SIPO.

I am attaching a power of attorney from Professor Van Gent confirming the present examination, and allowing for possible RCE or continuation.